

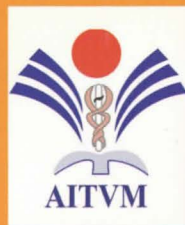
# Proceedings

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Does control  
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## **SEROLOGICAL FOLLOW UP OF RIFT VALLEY FEVER IN A SAHELIAN ECOSYSTEM IN 2004**

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### **ABSTRACT**

In 2003, a serological study performed in the Ferlo area (northern Senegal), showed that (i) Rift valley fever was endemic; (ii) the risk of transmission depended on the pond type (Chevalier, *et al.* 2005). In 2004, a serological longitudinal survey was undertaken in the same area. A total of 260 sheep were sampled three times: starting, middle and end of the rainy season. Sera were tested for anti-RVF immunoglobulin G (IgG) using a seroneutralization test. Statistical analyses were performed using a generalized linear model, with the incidence as the response and the period as the explanatory variable. The overall incidence rate was lower than in 2003 (1.7% vs 5.4%). The observed incidence rate was 3% (n= 166) from August till early October. It was 5.10<sup>-3</sup> % (n = 177) from early October till the end of November. These results associated with entomological knowledge suggested that the main period of transmission is the middle of the rainy season. Ponds infected in 2003 remained infected in 2004. Rift Valley fever is endemic in this area but the way the virus is maintained in the field remains unknown. Assumptions on the persistence mechanisms are formulated. The relevance of vaccination is discussed.

### **INTRODUCTION**

The Ferlo area is a sahelian ecosystem located in northern Senegal. This region is characterized by a temporary pond network. These ponds fill up in July with the first rainfalls, and dry in November for the largest ones. A serological study performed on sheep demonstrated an intense circulation of Rift Valley fever (RVF) associated with numerous abortions in this area in 2003 (Chevalier *et al.*, 2005). The risk of transmission was spatially heterogeneous, and linked to the pond type.

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In 2004, a serological longitudinal survey was undertaken in the same area. The goals of the study were: (i) to perform a serological assessment of the Rift Valley fever virus circulation in the Ferlo in 2004 (ii) to identify the main period of transmission, (iii) try to confirm the spatial heterogeneity of the risk

## **MATERIAL AND METHODS**

Six of the seven temporary ponds selected for the 2003 study, namely Barkedji, Furdu, Niaka, Kangaedji, Ngao and Yaralope were included in the survey. Meetings were organized at the beginning of the rainy season with the farmers to explain the goal of the study. Based on the willingness of farmers, ten compounds were included in the study. In each compound, sheep were randomly chosen and ear-tagged. Sampling was performed in early August for the first session, in early October for the second, and at the end of November for the last session. Blood samples were centrifuged and stored at -20°C. Sera were tested for anti-RVF immunoglobulin G (IgG) using a seroneutralization test. Statistical analyses were performed using a generalized linear model with the incidence, aggregated at the pond level as the response. The sampling period, from August to early October (P1), from October to November (P2), was the explanatory variable.

## **RESULTS**

Due to logistical constraints, the provisional schedule could not be achieved in Yaralope pond. Sheep were sampled only once, in early August. The observed prevalence rate at the beginning of the rainy season was 2.7% (n= 260). The overall incidence rate was lower than in 2003 (1.7% vs 5.4%). The observed incidence rate was 3% (n= 166) from August till early October. It was  $5.10^{-3}$  % (n = 177) from early October till the end of November. No significant difference between these two incidence rates could be demonstrated. Ponds infected in 2003 were found infected in 2004. Barkedji pond and Yaralope pond that were free from RVF circulation in 2003 remained free at the beginning of the 2004 rainy season. The observed incidence rate in Barkedji remained null in 2004.

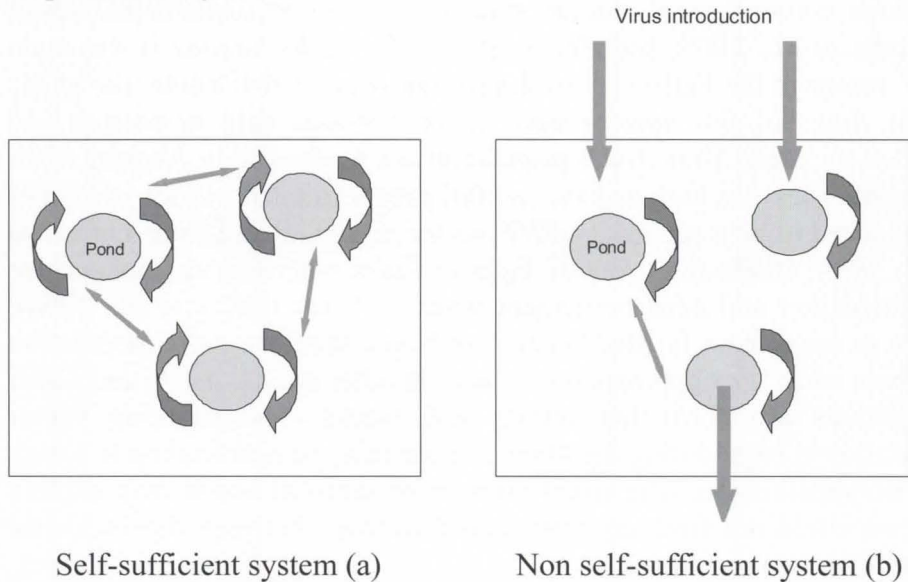
## DISCUSSION

The observed incidence rate was lower in 2004 than in 2003 (1.7% vs 5.4%). Two assumptions may be formulated: (i) the viral circulation observed in 2003 may have induced a significant protective immunity; (ii) ecological conditions –namely the rainfall pattern – was unfavourable to the virus transmission. These results suggested that the main period of transmission is the middle of the rainy season, namely September. Previous entomological studies may be relevant to explain that result (Mondet *et al.*, 2005; Mondet *et al.*, 2005). *Aedes vexans* is the main RVF vector in the Ferlo (Traore-Lamizana *et al.*, 1994; Fontenille *et al.*, 1998). Eggs of this species need to be consecutively desiccated and flooded to hatch. Thus *Aedes* population use to decline in August, when the rainfall level is high and the rainfall events frequent. *Culex poicilipes* is supposed to be a secondary RVF vector in this area (Traore-Lamizana *et al.*, 1994; Diallo *et al.*, 2000). Eggs of *Culex poicilipes* can not survive to desiccation and need permanent water to hatch (Beaty *et al.*, 1996). When ponds remain flooded because of heavy rainfalls, *Aedes* population decrease and *Culex* population increase. In other words, *Aedes* and *Culex* populations are coexisting during few weeks. The resulting vector population is large during the middle of the rainy season leading to a high risk of transmission. The small number of sampled sheep may explain that we could not find any statistical difference between the incidence rates of the two periods.

Even if the spatial heterogeneity of the risk could not be demonstrated in 2004, ponds infected in 2003 were found infected in 2004, and safe ponds in 2003 remained safe in 2004/ the risk of transmission probably depends on the pond type. Whether the explanatory variable is linked to the pond structure, the water composition, the water vegetation or the surrounding vegetation remains unknown. These environmental variables should be identified. Then remote sensing methods could help to identify risky ponds of the whole area to focus the existing monitoring system on them (Thiongane *et al.*, 2003).

Rift Valley fever is endemic in this area. However the way the virus persists in the region remains unknown. Two assumptions may be formulated (figure 1). In the first case (a), the RVF virus is maintained in pond depending micro-cycles thanks to a vertical transmission in *Aedes vexans*. This mechanism was demonstrated in East Africa for *Aedes mcintoshi* (Linthicum *et al.*, 1985). In the second case, the RVF virus is

regularly introduced in the Ferlo area via nomadic herds coming from infected areas such as Mauritania. These two assumptions may co-exist. According to these mechanisms, vaccination scenarios should be tested and applied. Since the main period of transmission is September, and since sheep and goats are not pregnant in July, it could be relevant to vaccinate resident and nomadic herds when they arrive in the Ferlo, at the end of July, with the Smithburn vaccinal strain, in order to stop the amplification cycle.



**Figure 1.** Assumptions on the mechanisms of the Rift Valley fever virus maintenance in the Ferlo area.

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